



STOCK ASSESSMENT ON SUBDIVISION 3PS HADDOCK (*MELANOGRAMMUS AEGLEFINUS*)

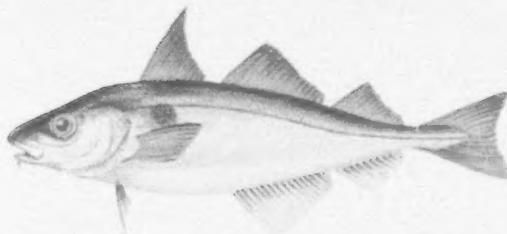


Image: Haddock, (*Melanogrammus aeglefinus*)

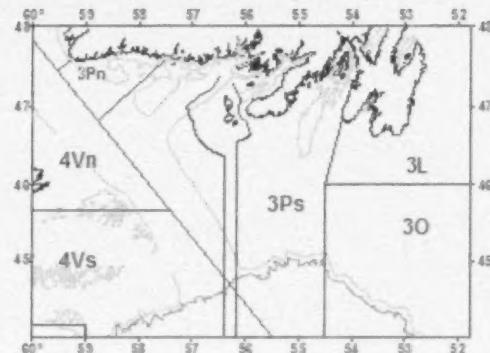


Figure 1. Subdivision 3Ps management area.

Context:

Haddock occur on both sides of the North Atlantic; on the North American coast, it ranges from the Strait of Belle Isle south to Cape Hatteras, being more abundant in its southern range.

Haddock are primarily bottom feeders and food varies with size. Those less than 50 cm eat crustaceans, in particular, amphipods, pandalid shrimp and hermit crabs. Also the diet includes echinoderms (brittle stars, sea urchins and sand dollars), molluscs (snails and clams) and annelid worms. In Haddock greater than 50 cm small fish make up about 30 % of the diet with Sand Lance, Capelin, Silver Hake, Herring and Argentines being consumed. When available, large numbers of Herring and Capelin eggs are eaten. Spawning occurs on Saint Pierre Bank in spring. Haddock larvae are pelagic, settling when 50 mm. Males and females attain sexual maturity at ages 3-5 years; males usually at a slightly younger age than females. Growth rates vary and are generally slower in northern stocks.

From 1954-1956, a substantial Haddock fishery occurred on St. Pierre Bank. This fishery was prosecuted mainly by Canada with increased effort by Spain and France (St. Pierre and Miquelon) over this period. This fishery was almost exclusively made up of the abundant 1949 year class. Landings peaked at 58,000 t in 1955.

This Science Advisory Report is from the St. John's NL, January 29-30, 2014 Regional Peer Review; 3Ps and 3LNO Haddock, 3Ps Pollock, and 3Ps American Plaice Stock Assessment. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

SUMMARY

- Catch ranged from 147 t to 58,000 t from 1953 to 1992. The stock has been under moratorium to directed fishing since 1993. Since then catch has averaged 277 t with catch in the most recent 5 years averaging 166 t.
- Two large recruitment events have been observed in this stock. One year class in each of the 1940s and 1980s supported larger than average catches.

- Biomass and abundance have varied without trend in the Campelen survey (1996–2013).
- The survey indices have varied without trend since 1996 while catch has ranged from 84 to 621 t (average 252 t). Catches above this range should be treated with caution until there is evidence of an increase in stock size.

BACKGROUND

Four stocks were assessed as part of a Groundfish update from the Newfoundland region. These were Subdiv. 3Ps Haddock, Pollock, Plaice and 3LNO Haddock. The status of the Haddock stock in NAFO Subdivision 3Ps (St. Pierre Bank) was last updated in 2005 (DFO 2005a) and fully assessed in 2001 (DFO 2001/A2-05). The current assessment is requested by Fisheries and Aquaculture Management to provide the Minister with advice that will inform the management decisions for the 2014 fishing season.

ASSESSMENT

Fishery

The directed fishery for Haddock in Subdivision 3Ps occurred mainly in the 1950s. Catch ranged from 147 t to 58,000 t from 1953 to 1992. Landings peaked in 1955 at 58,000 t, due mainly to the abundant 1949 year class (Figure 2). The 1981 year class recruited to the fishery in 1984 and catches rose again in 1985 (~8000 t); however, at much lower levels than the 1950s. The stock has been under moratorium to directed fishing since 1993. Since then catch has averaged 277 t annually with catch in the most recent 5 years averaging 166 t.

Analysis of the Canadian bycatch of Haddock over the past five years, indicates that, on average, 60 % of the landings came from the Cod fishery, 40 % from the mixed White Hake fishery and 13 % from the Witch Flounder fishery (this was only important for one year). It is also taken in Redfish, Monkfish, Skate, Atlantic Halibut and Greenland Halibut fisheries. Otter trawl made up 40 % and gillnets 45 % of Haddock bycatch.

Sampling of the commercial fishery was infrequent but indicated that the length composition of the commercial catch ranged between 50–70 cm. In 2010, the otter trawl sample indicated a peak in catch at 45 cm, which is likely the 2006 year class. This year class makes up most of the catch for the next two years.

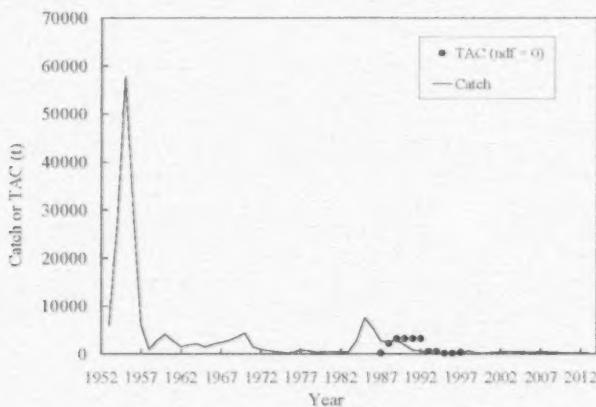


Figure 2: NAFO Subdivision 3Ps Haddock landings and TACs from 1953 to 2013.

Research Vessel Surveys

Canada has conducted research vessel (RV) surveys in NAFO Subdivision 3Ps using the stratified random design since 1972. Surveys were conducted mainly in February to March prior to 1993 but since then have been conducted in April. The survey covered only a few strata deeper than 400 m before 1979; since then depths of up to 750 m are surveyed annually.

There is no analytical assessment for Subdivision 3Ps Haddock. From 1972 – 1983 a Yankee 41.5 otter trawl was used in the surveys. In 1983, the research vessel was fitted with an Engel 145 otter trawl and this gear was used until 1996, when the gear was changed to the Campelen 1800 trawl. Although comparative fishing was carried out between these gears, no conversion factors have been developed for Haddock. Therefore the time series from each gear cannot be compared directly.

Biomass and Abundance

Haddock biomass in Subdiv. 3Ps was low from 1972 – 1983 and then increased and peaked in 1985, then declined to low levels. Biomass and abundance have varied without trend in the Campelen survey (1996-2013). The large estimates of variance in 2007 are due to one large tow of small Haddock.

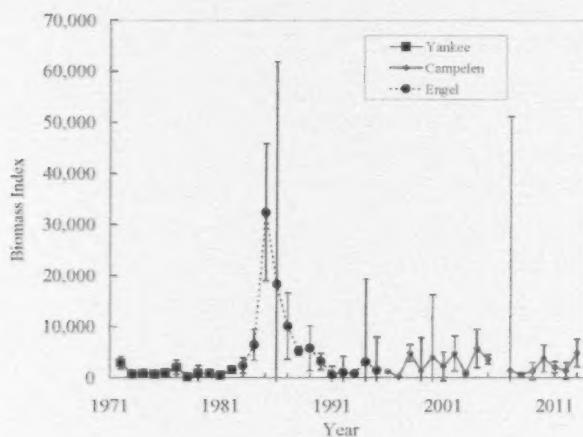


Figure 3: Biomass index for Haddock from annual Subdiv. 3Ps Canadian RV surveys 1972-2013.

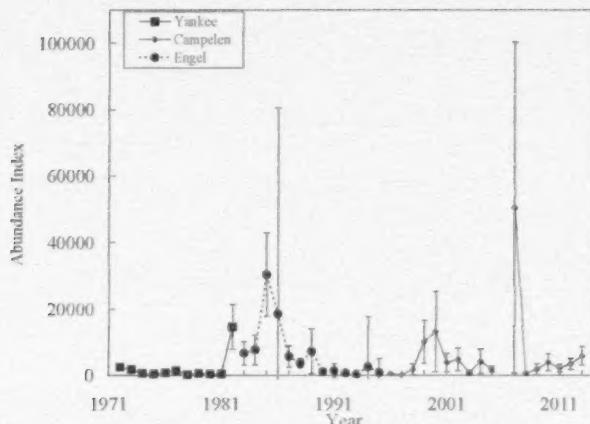


Figure 4: Abundance index for Haddock from annual Subdiv. 3Ps Canadian RV surveys 1972-2013.

Length Frequencies

Population numbers at length indicate that some year classes are strong and can be followed for several years. The size compositions of the most recent years suggest the presence of larger and presumably mature fish. Two large recruitment events have been observed in this stock. One year class in each of the 1940s and 1980s supported larger than average catches.

The index of spawning stock biomass was highest in the mid-1980s and variable during the Campelen period. Average length at 50 % maturity over the entire time series is 50 cm for both sexes.

Distribution

Plots of mean weight and mean number per tow by year indicated that most Haddock catches in the survey are rarely found outside the 100-300 m depth contour. In the 1980s Haddock catches were distributed near the edge of Burgeo Bank and along the western edge of Saint Pierre Bank. In recent years, catches are distributed mainly at the bottom of Halibut Channel. This change may be due to the timing of the survey rather than an actual shift in distribution.

Other Information

Surveys conducted by the Centre for Fisheries Ecosystems Research in Subdivision 3Ps during 12-22 May 2012 and 16-18 May 2013 revealed aggregations of Haddock along the edges of Halibut Channel and the western shelf slope of St. Pierre Bank. In 2012, Haddock length ranged between 18-78 cm ($n = 351$) with modes at approximately 23 cm and 56 cm. In 2013, there was a large mode at 31 cm although fish up to 83 cm in length were also observed ($n = 1403$). Estimates of ages, based on otolith sections, revealed that fish ranged from 1 to 14 years of age with 2006 and 2011 cohorts featuring prominently in the survey catch. Examination of gross morphology of the gonads revealed many individuals to be approaching spawning or spent and that 50 % of females had reached sexual maturity by 41 cm. Individual growth rates and length at maturity during 2012-2013 appeared similar to those observed for this stock in the past.

Ecosystem

There is a clear warming signal in Subdivision 3Ps; since the early 1990s, bottom temperature during the spring survey has been increasing at an average rate of around 3 % per year. Although trends in the fish community in the 1980s and early 1990s are potentially confounded with changes in the RV survey (e.g. timing of survey, sampling effort, gear change), it seems clear that the fish community declined during the mid-1980s and early 1990s. This decline was also accompanied by a decrease in the average fish size. Overall, the biomass and abundance of the fish community has increased since the mid-1990s. Increases in biomass have been moderate, while increases in abundance have been clearer and led by planktivore species like Sandlance, and to a lesser extent Herring. During this period, average fish size has shown ups and downs, without a consistent trend. Changes in biomass/abundance (BA) ratio at the fish community level can be explained by changes in community composition, like recent increases in planktivores. Among piscivores, Atlantic Cod is the dominant species in this functional group. Pollock has shown fluctuations over time, with 2010 and 2012 being relatively strong years compared to all others. During the early 2010s, dominance of Cod seems to be increasing among piscivores, but other gadoids (e.g. Silver Hake) also seem to be increasing within this functional group. Among large benthivores, American Plaice biomass levels have shown very few changes since the mid-1990s. This functional group has been dominated by Thorny Skate and American Plaice. Haddock has shown fluctuation but is not a dominant species among large benthivores. The observed warming of this system, together with recent increases of "warmer-water" species like Sandlance, Silver Hake, and Pollock suggests that this ecosystem could be undergoing structural changes.

There is limited diet information for Subdivision 3Ps. The available data for American Plaice (Spring 2013) indicates a diet dominated by Sandlance, brittle/basket stars and other echinoderms. This is different from Divisions 3LNO samples which show a diet with a higher proportion of Capelin and Sandlance.

Ocean Climate Conditions

A key indicator of ocean climate conditions on the Newfoundland and Labrador (NL) Shelf, the North Atlantic Oscillation (NAO) index, returned to a negative phase in 2013 and as a result arctic air outflow to the Northwest Atlantic during the winter decreased over the previous year. This appears to have resulted in an increase in winter air temperatures over much of the Labrador Sea area causing a continuation of less sea-ice than normal on the NL Shelf. As a result of these and other factors, local water temperatures remained above normal in most areas in 2013 but show a decrease over 2011-12 values. In particular, average Subdivision 3Ps bottom temperatures decreased from 3.3 °C to 2.9 °C, an approximate decrease of 1 standard deviation. In general, all environmental indices indicate a continuation of the warmer than normal trend throughout the area since the mid-1990s. During the past 2 years however temperatures have decreased compared to the record warm conditions of 2011.

Sources of Uncertainty

This stock tends to experience episodic recruitment, giving rise to strong year classes that can support a fishery. Environmental conditions play a large role in survival of recruits.

The degree of mixing between Haddock in Subdivision 3Ps and Divisions 3LNO is not known. There appears to be some recruitment synchrony even though based on persistent differences in growth rates and year class compositions, they are considered separate stocks.

Current lack of conversion factors for the survey prior to 1996 and episodic recruitment are impediments to the determination of reference points.

CONCLUSION

The survey indices have varied without trend since 1996 while catch has ranged from 84 to 621 t (average 252 t). Catches above this range should be treated with caution until there is evidence of an increase in stock size.

SOURCES OF INFORMATION

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DFO. 2005. [Stock Assessment Update on Groundfish in Newfoundland and Labrador Region](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2005/051.

DFO. 2001. [Subdivision 3Ps Haddock](#). DFO Can. Sci. Advis. Sec. Stock Status Rep. A2-05(2001).

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